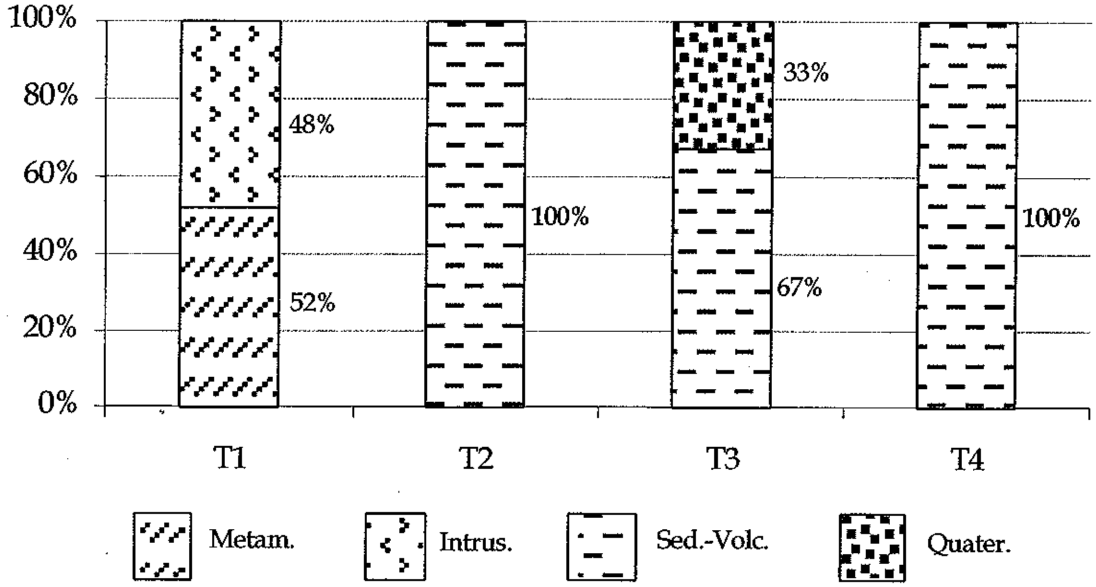
Figure A2.4 Rock type distribution in percentge and by length for each tunnel on the I-5 alternative alignment (with reference to the 2.5% max grade)



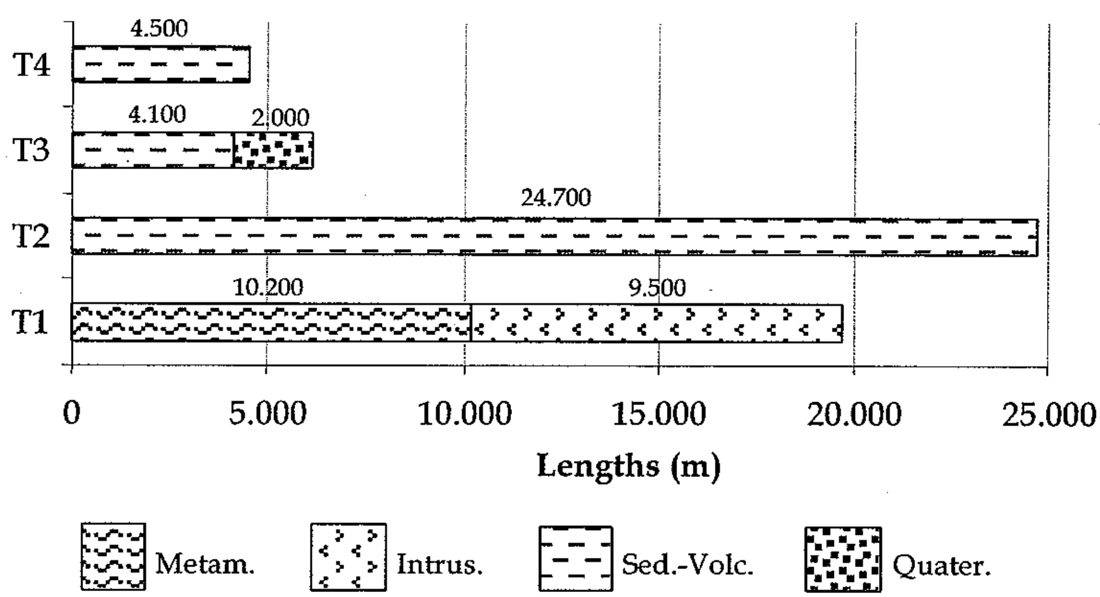
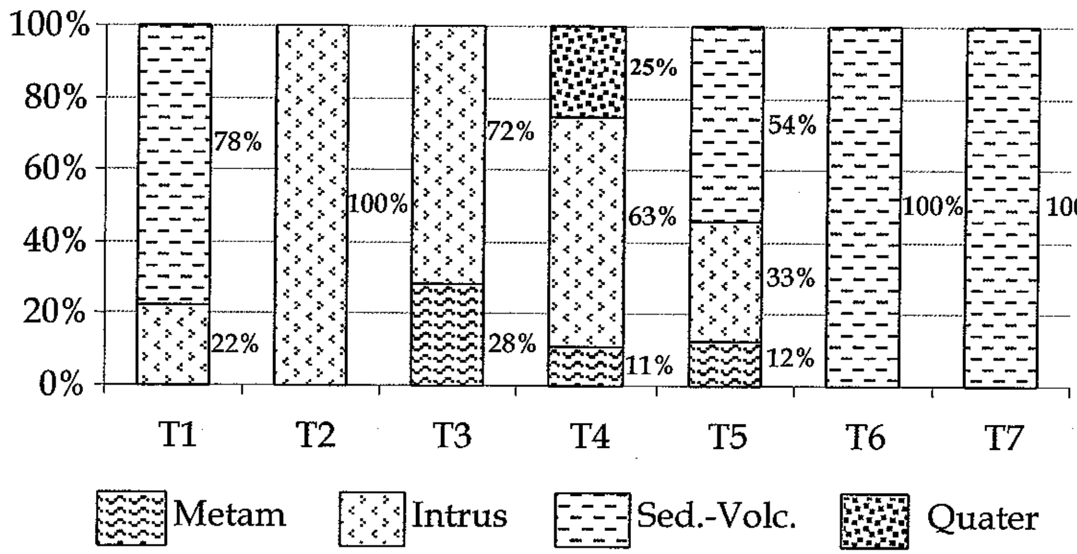
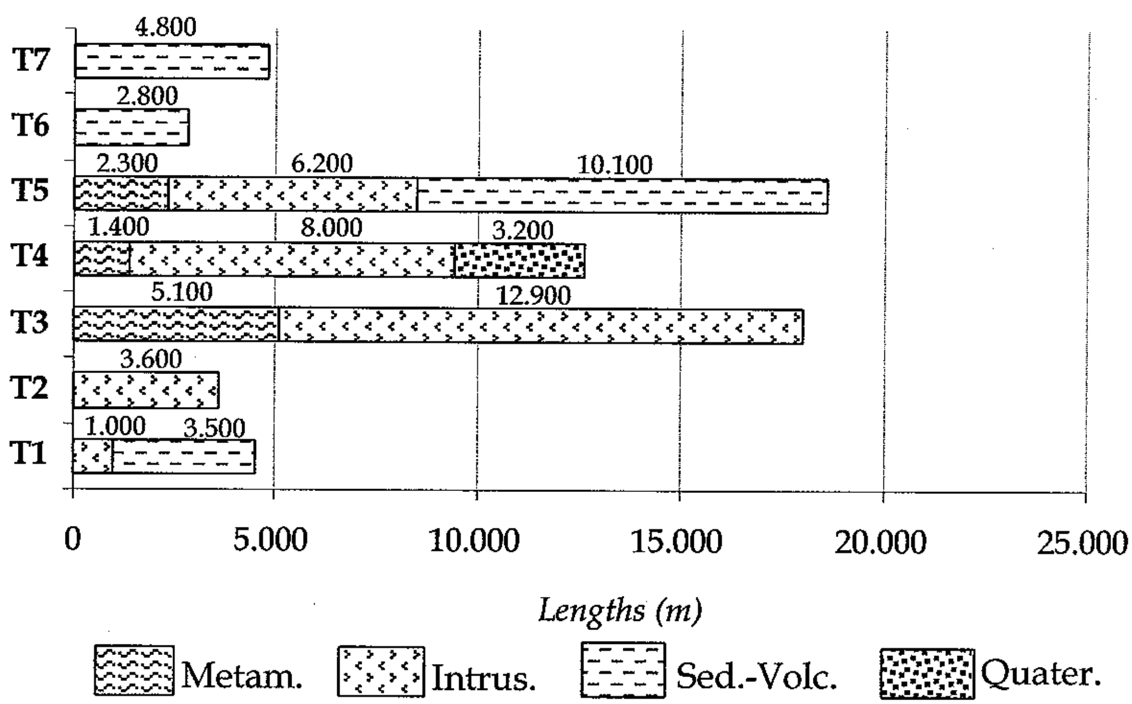


Figure A2.4 Rock type distribution in percentge and by length for each tunnel on the Antelope Valley alternative alignment (with reference to the 2.5% max grade)





The characteristics of the principal geological formations that are expected to be encountered in tunneling, for both alignment options, are described in the following sections.

Pre-Cenozoic crystalline rocks

- <u>Precambrian anorthosites</u>

Medium to very coarse-grained hornblende plagioclase rock; it outcrops in the San Gabriel Mountains area. It could be deeply weathered, broken and shattered with local, hard, slightly weathered to unweathered remnants. In the Soledad Canyon zone it appears to be in tectonic contact with more recent sedimentary units (Vasquez Fm).
Antelope Valley(AV) alignment (Soledad Canyon section)

- <u>Paleozoic to Cretaceous metamorphic rocks</u>

Moderately-foliated, fine-grained phyllites (Paleozoic) with interbedded marble and quartzite layers; this metamorphic complex is abundant towards North of Tehachapi Mountains where it is associated with younger intrusive rocks.
AV alignment

Probably of Paleozoic age highly foliated, sheared and faulted biotitic schists rich in quartz feldspar lenses are found along the Tehachapi Mountain chain where they are strictly associated with and bounded by main regional tectonic structures (Garlock fault zone).
AV alignment (Tehachapi Mountains section)
Cretaceous gneiss, amphibolite and granulite metamorphic complex is present in the northern side of the San Emigdio mountains; the complex is expected to be intensely fractured and weathered also at considerable depths. A Mesozoic to Paleozoic interlayered pile of calcareous, siliceous and pelitic rocks (Keene unit) is present along the tectonic contact between the previous metamorphic complex and the granitic rocks to the South.
I-5 alignment (Grapevine peak)

- <u>Cretaceous intrusive rocks</u>

In terms of relative abundance, they represent the second lithologic group as shown in Figure A2.5; they range in composition from granites, granodiorites, tonalites to quartz diorites and quartz monzonites and are known in the literature under various names. Their geomechanical properties are expected to cover the entire range (from good to very poor) of conditions in relation to specific topographic and tectonic settings.
Both I-5 and AV alignments

Tertiary sedimentary and volcanic rocks

- <u>Vasquez Formation</u>

It consists of coarse clastics, deposited upon volcanic rocks released as the North American tectonic plate initially collided with the Pacific Plate.

Figure A2.6 gives a typical appearance of Vasquez rock formation. The sediments at Vasquez formation were deposited above and with numerous basalt flows that constitute a major portion of the lower sequence; repeated episodes of uplift to quiescence produced several distinctive sequences called megacycles. These megacycles are characterized by coarse clastic sand and gravel deposits at the base of the sequence (as uplift became strong) with an upward fining progression (as tectonic activity slowed down) into the siltstones and shales of a distal alluvial fan playa depositional environment.

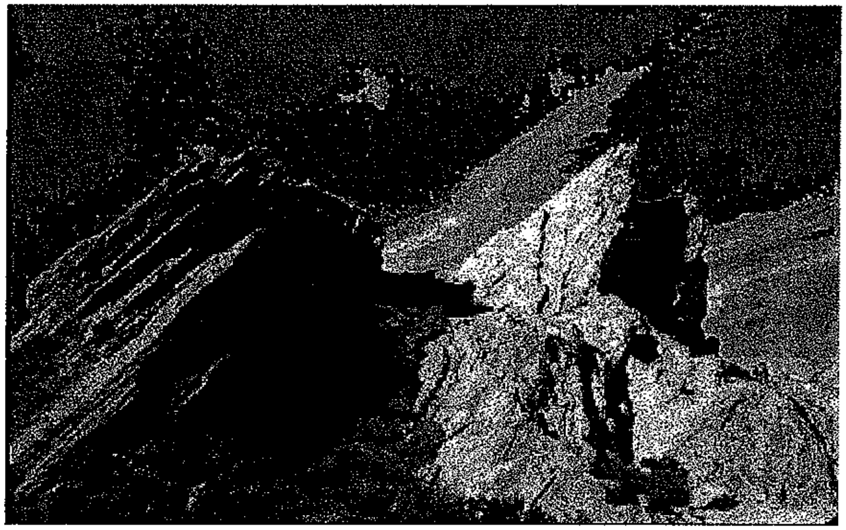


Figure A2.6 Typical appearance of Vasquez rocks

AV alignment (Soledad Canyon section)

- Saugus Formation (Pliocene to lower Pleistocene)

Clastic sedimentary unit composed of two principal facies.
A marine Pliocene facies, composed of sandstones, mudstones, red conglomerates beds and thin limestone beds. A fluvial Pliocene Pleistocene facies, consisting of sandstones, conglomerates and siltstones, described as loosely consolidated to poorly cemented.
In the San Gabriel Mountains region, it underwent intense folding by north south directed compressional forces that were associated with the mid-Pleistocene major orogenetic event of San Gabriel Mountains building.
Both *I-5 and AV alignments*

- Ridge Basin Group (Miocene to Pliocene)

Clastic sedimentary units composed of interlayered and interfingered sandstones, siltstones and claystones; each singular lithotype can locally constitute the prevailing rock unit. The sandstone unit is highly folded, fractured and jointed in the vicinity of the major tectonic structures.
I-5 alignment

- Castaic Formation (Miocene)

Shallow marine clastic, moderately lithified unit. Prevailing facies is composed of a thin bedded claystone (crumbly where weathered) with minor, thin sandstone layers. A secondary interlayered facies is composed of fine to medium grained arkosic cohesive sandstones interbedded claystone levels.
I-5 alignment

- Towsley Formation (upper Miocene to lower Pliocene)

Fairly well indurated with lightly, well cemented interbeds of siltstones to sandstones, with local well cemented pebble conglomerate and beds of breccia. They outcrop in the Santa Susana Mountains range where they are expected to be tectonically quite disturbed. Squeezing behavior of claystone layers was reported during the 60's when the 8m-diameter Newhall tunnel was constructed.
Both *I-5 and AV alignments*

- Pico Formation (Pliocene to Pleistocene)

Marine siltstones, sandstones and red conglomerate beds, fairly well indurated with lightly well-cemented interbeds
I-5 alignment

Quaternary deposits
Mainly alluvial type sedimentary deposits ranging form more recent, unconsolidated, undisected valley fill (gravels to silt grained) to older slightly-consolidated deposits. The deposits can reach considerable thickness also along the piedmont areas (300 to 350 ft. exposed thickness in the Mojave zone).
Both *I-5 and AV alignments*

2.4 Groundwater conditions

Groundwater in the considered area is contained in three major aquifer systems which consist primarily of basin fill deposits that occupy structural depressions caused by crustal deformations. The basin-fill aquifer systems are the Basin and Range aquifers, the Central Valley aquifer system, and the Coastal Basins aquifers.

The principal water yielding units are unconsolidated, continental, clastic deposits of Tertiary age that partly fill structural basins created by faulting. Volcanic rocks, which are principally lava and pyroclastic flows of Tertiary age, are important aquifers in some sparse, non contiguous areas.

The recharge of aquifers, which occurs mainly through runoff from precipitation in the surrounding mountains, infiltrates the permeable sediments of the valley floor either at the basin margins or through streambeds.

Confined or semi-confined aquifers are also known to exist in some places, particularly where interlayering and overlapping of fine and coarse sediments do occur (e.g. in the sediment-filled tectonic depression of Antelope Valley where a deeper artesian aquifer is separated from the upper freatic aquifer through fine lacustrine clays).

For the present study no detailed hydrogeologic information was available concerning hydrogeologic regional setting in the mountainous zones: i.e., no data on the hydraulic heads, permeability distributions, flow nets, hydraulic tests. Consequently, a very qualitative hydrogeological characterization has been carried out that allowed the distinguishing of the zones in which tunneling operations could be negatively affected by potential water inflows from the zones where hydrogeologic occurrences, if any, should not cause significant impacts.

Basement rocks (granite-like and metamorphic units) which build up the lower and lateral bound of the basin fill deposits can be normally considered as relatively impervious.

Groundwater flow through rock-like materials is basically controlled by discontinuities in rock masses; intact rocks can be considered practically impervious to water flow (due to very low primary porosity and low degree of pore interconnectivity), whereas water circulation in open fissures, joints, solution cavities is strongly facilitated.

Localized water bearing geologic structures, connected to and recharged from basin fill aquifers and from lakes and streams, are represented by areas of intense rock deformation and rupture such as folds and faults. Where the permeability of the rock material has been strongly enhanced due to tectonization, crushed basement rocks are also important water bearing features with enough effective storage and sufficient permeability to act as a local groundwater reservoir.

Anomalous hydraulic differential heads (in both vertical and horizontal directions) can develop through shear zones due to the presence of impermeable barriers made up of finegrained and weathered fault gouges. Such a condition is of particular relevance for all the numerous underground fault crossings.

2.5 Geomechanical characterization methodology

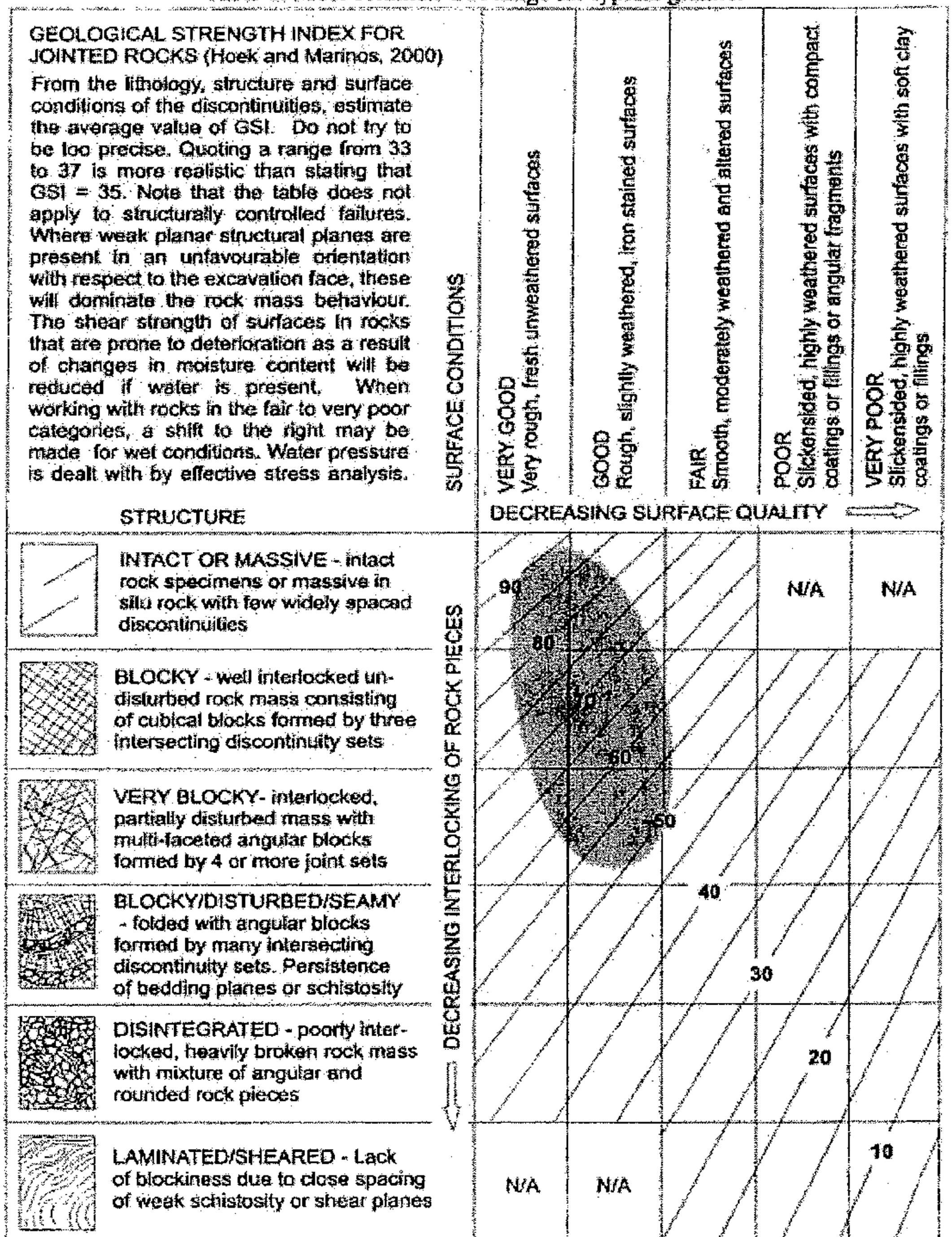
At the present stage of the study, geotechnical and geomechanical data about the geologic units that will be encountered in tunneling are not available.
In order to establish a reference geomechanical frame that permits the describing and classifying of the excavation conditions for tunneling, a simplified approach has been adopted which involves a two-step process:

- First, classify all the geologic units involved in each tunnel alignment into Geomechanical Groups according to the GSI (Geological Strength Index) system proposed by Hoek et al. (1995-2002), that is, assigning characteristic GSI-values to each unit present at the tunnel elevation and subsequently to the right Geomechanical Group;
- Then, determine the behavior class of each geologic unit according to the system proposed by Russo et al. (1998), considering not only the possible geomechanical characteristics of the unit (represented GSI) but also the corresponding in-situ stress conditions (generally, assumed to be geostatic, i.e. only proportional to the thickness of the overburden).

Practically, for Step 1 a characteristic range of GSI is attributed to each geological unit through visual comparison of its "imagined" characteristics with those shown on the special, standard charts by an experienced engineering geologist. As a result, the average, best and worst conditions are obtained. Figures A2.7 and A2.8 present two examples of such GSI charts, comparing two rock types with the standard chart (granite on Figure A2.7, and siltstones and claystones on Figure A2.8, respectively).

Figure A2.7 GSI chart for granites (after Marinos and Hoek, 2000)

Table 8: Most common GSI range for typical granite.*

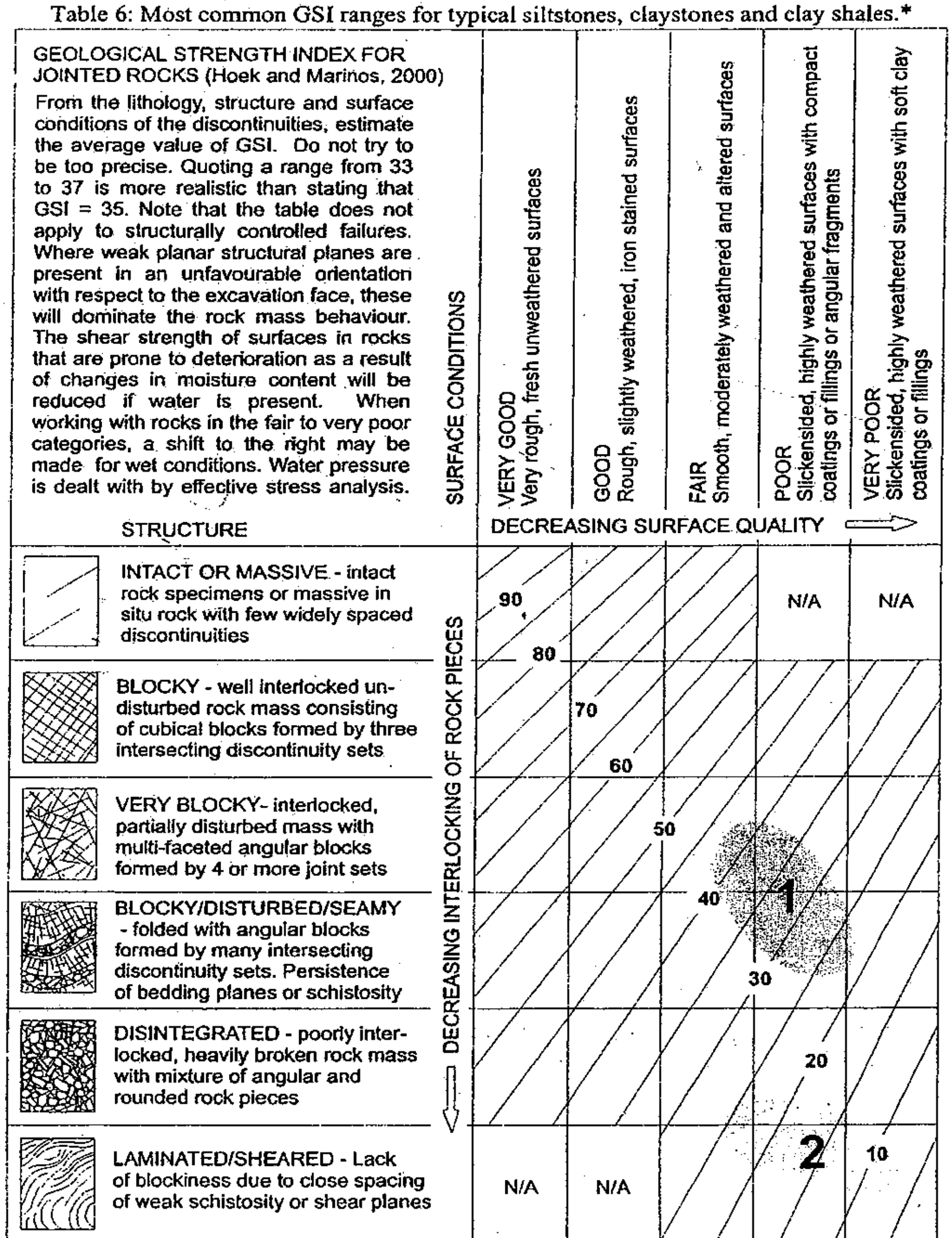


******WARNING*:
The shaded areas are indicative and may not be appropriate for site specific design purposes.
Mean values are not suggested for indicative characterisation; the use of ranges is recommended

Only fresh rock masses are shown. Weathered granite may be irregularly illustrated on the GSI chart, since it can be assigned greatly varying GSI values or even behave as an engineering soil.

Figure A2.8 GSI chart for siltstones and claystones (after Marinos & Hoek, 2000)

Table 6: Most common GSI ranges for typical siltstones, claystones and clay shales.*



*WARNING:
The shaded areas are indicative and may not be appropriate for site specific design purposes. Mean values are not suggested for indicative characterisation; the use of ranges is recommended

1. Bedded, foliated, fractured
2. Sheared, brecciated

These soft rocks are classified by GSI as associated with tectonic processes. Otherwise, GSI is not recommended. The same is true for typical marls.

After the definition of geomechanical groups, the analysis of the excavation behaviour of rock masses around the excavation has been carried out, taking into account the existing stress conditions at the assumed tunnel levels.

Analysis are performed by combining the "Convergence-confinement" method (solution of Brown et al., 1983) and the probabilistic approach, through a spreadsheet model developed by Geodata (SIGRES); typical ranges for intact rock parameters, which are the necessary input to carry out such analysis (i.e., UCS, unit weight, etc.) were attributed to each rock type based on data derived from available literature. The latter is considered particularly adequate for the examined cases, in order to incorporate the actual uncertainties and the inherent variability of the geomechanical parameters.

The results of the simulations are classified on the basis of deformation indexes of the face and of the cavity (Russo et al., 1998), distinguishing six possible categories of behavior: from the best (Category "a") to the worst condition (Category "f"). A short description of the categories follows (see also Figure A2.9).

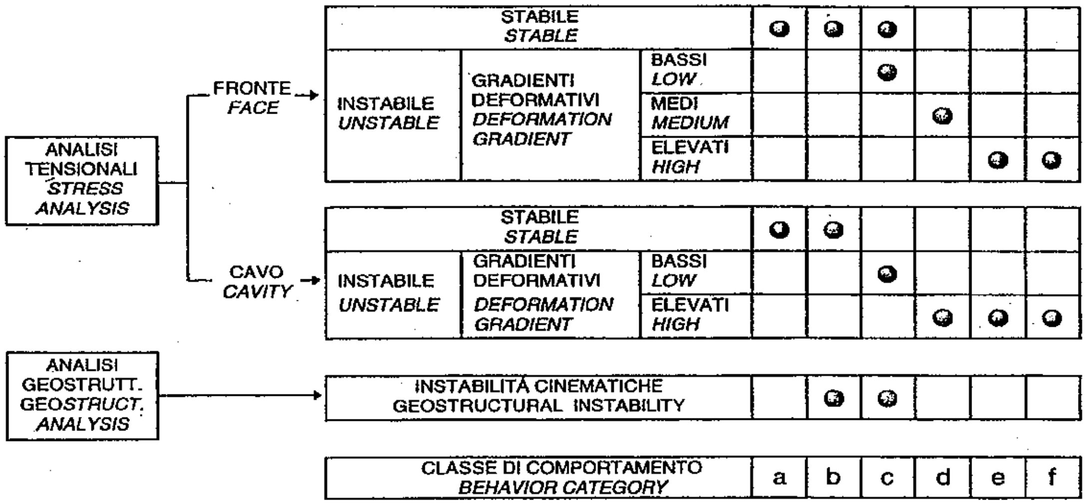
Categories "a-b"
In the behaviour categories "a-b", the strength of the rock mass exceeds the stress level at the face and around the cavity. The ground behaves elastically and in general deformations are of negligible magnitude. Instability phenomena are associated with wedge failure and seldom occur in category "a", where the rock mass is considered as a continuum, but joints are relatively abundant in category "b", where the rock mass is usually considered as discontinuous.

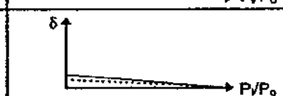
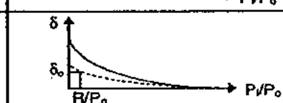
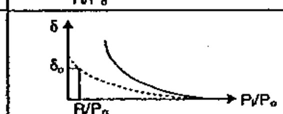
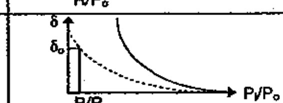
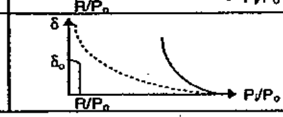
Category "c"
The magnitude of stress concentrations at the face approaches the strength of the rock mass (strength-to-stress ratio, S, is approximately one). The behaviour is elastic-plastic, resulting in minor instabilities. Nevertheless, the deformability gradient at the face is low, and the radial deformation (δ_o), defined as the percentage ratio of radial displacement at the face (u_o) to the equivalent cavity radius, R_o, is less than 0.5%. On the periphery of the cavity the stresses exceed the strength of the rock mass, S<1, resulting in the formation of a plastic zone around the excavation, having a width less than R_o. The formation of the plastic zone results in significant convergence until a new condition of equilibrium is reached.

Category "d"
The magnitude of stress concentrations at the face exceeds the strength of the rock mass. The face is in a plastic state. The deformation gradient is low for typical excavation advance rates; therefore, immediate collapse of the face (δ_o<1.0%) is prevented. The plastic state at the face in conjunction with the development of the plastic zone around the cavity results in a worse overall stability condition than that of category "c".

Category "e"
Category "e" differs from category "d" with respect to the magnitude of deformation at the face and away from the face. At the face the stress-to-strength state results in high deformation gradient and critical conditions of face stability (δ_o>1.0%). The width of the plastic zone is greater than R_o. Therefore, in practical terms, this category includes the highly "squeezing" condition.

Figure A2.9 Definition of the behavioural categories (after Russo et al., 1998)



Classe Category	Fronte *Face*	Cavo *Cavity*	Curve caratteristiche *Characteristic curve* al fronte - at the *face* (········) e o distanza - *at a dist.* (———)	Interventi di stabilizzazione *Stabilization measures* Funzione prev. *Primary function*	Tipologia *Type*
a	stabile *stable* S>1 (lievi instabilità di blocchi) (limited block instability)	Stabile *Stable* S>1 $R_p/R_o = 1$			
b	globalmente stabile *globally stable* S>1 (cinematisimi di blocchi) (wedge instability)	globalmente stabile *globally stable* S>1 (cinematisimi di blocchi) *(wedge instability)* $R_p/R_o = 1$		Confinamento *Confinement*	Radiale *Radial*
c	da stabile a leggermente instabile - *limit condition* S≅1 (bassi gradienti deformativi) *(low deformation gradient)* ($\delta_o \leq 0.5\%$)	Instabile *unstable* S<1 (poco spingente) *(light squeezing)* $R_p/R_o \cong 1\text{-}2$		>Confinamento *>Confinement*	Radiale *Radial*
d	instabile: fronte plasticizzato ma stabilità non critica *not critical face instability* (S<1) (medi gradienti deformativi) *(medium deformation gradient)* ($0.5\% < \delta_o < 1.0\%$)	instabile *unstable* S<1 (spingente) *(squeezing)* $R_p/R_o \sim 2\text{-}4$		Confinamento e/o miglioramento *Confinement and/or improvement*	Radiale ed eventualmente in avanzamento *Radial and eventually in advance*
e	instabile: condizioni critiche *critical instability* S<1 (elevati gradienti deformativi) *(high deformation gradient)* ($\delta_o \geq 1.0\%$)	instabile *unstable* S<1 (spingente) *(squeezing)* $R_p/R_o > 4$		Miglioramento e confinamento *Improvement and confinement*	In avanzamento e radiale *In advance and radial*
f	instabile a breve termine *short term stability* S<1 (immediate condizioni di colasso) *(immediate collapse)*	instabile *unstable* S<1		Miglioramento e/o confinamento *Improvement and/or confinement*	In avanzamento e radiale *In advance and radial*

Note:

S=Rapporto di mobilitazione (resistenza/sollecitazioni)
strength-to-stress ratio

R=Resistenza mezzo nucleo - *strength of half nucleus*

δ=deformazione radiale (rapporto spostamento radiale /R_o)
radial deformation defined as the percent ratio of radial displacement (u_r) to R_o

δ_o=deformazione radiale scontata al fronte - *radial deformation at the face*

R_p=Raggio plastico - *plastic zone radius*

R_o=Raggio equivalente galleria - *equivalent tunnel radius*

Confinamento: Intervento teso ad evitare la decompressione della roccia e quindi il suo decadimento

Confinement: Measures to avoid relaxation and preserve the inherent rock mass strength

Miglioramento: Intervento teso a migliorare le caratteristiche geomeccaniche della roccia all'estradosso

Improvement: Measures to enhance rock mass characteristics around the cavity

Definizione delle classi di comportamento - *Definition of behavior categories*
(Russo et al., 1998)

Category "f"
Category "f" is characterised by immediate collapse of the face during excavation (impossible to install support). This behaviour is associated with non cohesive soils and cataclastic rock masses such as those found in fault zones, especially under conditions of high, hydrostatic pressure and/or high in-situ stresses.

With specific reference to mechanized tunneling using TBMs, as in the present case, it can be observed that "a" to "d" categories are generally not associated with significant problems for the advancement of the boring machine, while the opposite situation is related to the category "e" (highly "squeezing" condition) and category "f" (immediate collapse of the cavity).

APPENDIX 3 UNIT COSTS OF SOME EUROPEAN TUNNEL PROJECTS

The range of cost values used in the DAT analysis derives from the Consultant's experience gained from similar international projects. Table A3.1 gives a summary of the unit costs (cost per linear meter of tunnel) for different excavation methods of some European high-speed rail projects. The unit costs include the cost of excavation, temporary support and permanent support.

Specifically, the tunnels listed in the table refer to the Gotthard and Lötschberg tunnels in Switzerland, the base tunnel (also known as the Alpetunnel) of the High-Capacity Railway between Turin and Lyon, the High-Speed Railway tunnel between Bologna and Florence, the Monginevro railway tunnel at the border of Italy and France, the Somport tunnel crossing the border of France/Spain, and the Guadarrama tunnel on the High-Speed Railway in Spain.

Table A3.1 Summary of unit costs of some European tunnel projects

Tunnel (Length)	Type of Work	Excavation Method	Rock Quality	Diameter /Section	Cost (US$/m)
Lötschberg (36km)	Railway Tunnel	TBM	Good	9.5m	7500
			Poor		19000
Gotthard (57km)	Railway Tunnel	TBM	Good	9.5m	7400
			Poor		24950
	Shaft (840m)	CONV	-	8.4m	43000
Lugano	Shaft (375m)	CONV	-	7.0m	30300
Alpetunnel (54km)	Railway Tunnel	TBM	Good	9.0m	12600
			Medium		15240
			Poor		30120
		CONV	Good	9.0m	13950
			Medium		18150
			Poor		40000
	Access Tunnel	CONV	-	$70m^2$	24800
Monginevro (23km)	Railway Tunnel	TBM	Good	9.0m	8000
			Medium		9850
			Poor		18100
		CONV	Good	9.0m	11200
			Medium		14000
			Poor		19800
	Access Tunnel	CONV	-	-	14200
Bologna-Firenze	Access Tunnel	CONV	Good	$60m^2$	8200
			Poor	$90m^2$	13000
Guadarrama	Railway Tunnel	TBM	Good	9.5m	10200
	Access Tunnel	CONV	Medium	$75\ m^2$	12000
Somport	Motorway Tunnel	CONV	-	10.0m	10700

APPENDIX 4 REFERENCES

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PRIVILEGED AND CONFIDENTIAL FINAL DRAFT REPORT

SPRAWL OR SMART GROWTH

Analysis of High Speed Rail Alignments and Smart Growth

Prepared For The California High Speed Rail Authority and the

City of Palmdale, California

August 26, 2004

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Source of Graphic: City of Palmdale Department of Public Works, Capital Improvements Plan

Table of Contents

I. Introduction and Summary Findings

This Report has been prepared at the request of the City of Palmdale to provide an independent assessment of the two proposed High Speed Rail alignments for Southern California from Bakersfield to Los Angeles.

The California High Speed Rail Authority is considering two alternative rail alignments for Southern California. One segment passes directly from Bakersfield to Los Angeles (the "Grapevine" alignment), and the other stops in the City of Palmdale before continuing to Los Angeles (the "Antelope Valley" alignment). While both alignments include a Bakersfield station, only one services the growing demand for commuter rail and other alternative transportation systems in the north Los Angeles region. The Antelope Valley route should be selected by the Authority because it is consistent with state and regional "smart growth" and other land use environmental and economic development policies.

Smart Growth is at the forefront of land use policy for the new millennium for all of California and major coastal urban regions throughout the nation. A significant issue before the High Speed Rail Authority therefore is which of the proposed alignments creates urban sprawl or promotes smart growth. This requires consideration by the Environment Impact Report (EIR) of local and regional plan policies and the impacts of the alignments on agricultural lands, urban growth, and regional growth patterns.[1]

In 1969 I developed the "Ramapo Plan" establishing timing and sequencing of growth and argued the resulting litigation through the U.S. Supreme Court. The Ramapo plan was approved by the New York Court of Appeals (highest N.Y. Court) and the United States Supreme Court in 1972. *Golden v. Planning Board of the Town of* Ramapo 30 N.E. 2d 359, 285 N.E. 2d 138 (New York 1972), app. dismissed, 409 U.S. 1003 (1972) and was cited and approved in *Association of Homebuilders of the Greater East Bay, Inc. v. City of Livermore*, 18 Cal. 3d 582, 557 P2d473 (1976). It established the constitutionality of growth management in the United States. The Ramapo principles of requiring adequate public facilities linked to the priorities established in an 18 year capital improvement program has been the cornerstone of every major growth management system and Smart Growth in California and the U.S. (City and County of Los Angeles; San Diego; Ventura County; City of Riverside; Monterey County; Seattle-Puget Sound Council; Minneapolis-St. Paul; Miami-Dade County; Baltimore and Montgomery Counties (Wash. D.C.) (among over 200 city, county and regional land use-transportation growth management plans that Freilich, Leitner & Carlisle has designed, implemented and defended in the courts).[2]

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1 California Code of Regulations Title 14, Chapter 3 (Guidelines for Implementation of the California Environmental Quality Act) (hereinafter "CEQA Guidelines"), § 15125 ("EIR shall discuss any inconsistencies between the proposed project and applicable general plans and regional plans."

2 See Freilich, "FROM SPRAWL TO SMART GROWTH: SUCCESSFUL LEGAL PLANNING AND ENVIRONMENTAL SYSTEMS (Dec. 1999, American Bar Association)".

Twenty years ago Freilich, Leitner & Carlisle was requested by the Coalition for Los Angeles County Planning in the Public Interest, to assess whether Los Angeles County was properly implementing its General Plan goals, objectives, policies and strategies for retaining open space and containing urban sprawl through its development approval process.[3] The Report was incorporated into the Special Master's and Court's findings requiring implementation of the General Plan's Growth Management strategy. The Report called for enforcement of the adequate public facilities requirement of the General Plan designed in accord with the Ramapo principles of timing, phasing and sequencing of growth to avoid sprawl, leapfrog development, and prevent excessive loss of open space lands.

In 1991 Freilich, Leitner & Carlisle developed the transportation corridor overlay system for building permit allocations, which has formed the spine for transit in the City of Los Angeles. The project resulted from the building permit moratoria that was imposed upon Los Angeles by the EPA due to inadequate sewerage treatment. The allocation of building permits systems created a priority for construction along transportation corridors and centers and forms the backbone of the growth management strategy of the city to date.[4]

In analyzing the High Speed Rail Alignments, this Report endeavors to assess whether the alignments meet the criteria for Smart Growth set out in state plans and policies, local general plans, and the regional COMPASS plan under consideration by the Southern California Association of Governments (SCAG).

The Report carefully analyzes both the Grapevine and Antelope Valley alignments and strongly recommends that the Antelope Valley alignment is superior for the following reasons:

1. <u>The Antelope Valley Alignment Furthers Smart Growth Policies Embodied In State, Regional And Local Land Use Plans</u>. In California and nationally "sprawl" refers to unplanned, single use, auto dependent development built without regard to availability of infrastructure the need for which is generated by new growth. "Smart Growth" is the antithesis of sprawl. It channels growth either into (1) compact and sustainable development patterns within regional growth boundaries already served with infrastructure; or (2) within outlying new towns or communities with appropriate densities, mixed uses, affordable housing, sustainable walkable environments and adequate public facilities. The Antelope Valley alignment will encourage Smart Growth. The Grapevine alignment accomplishes the opposite - eliminating a station in the Antelope Valley, it will disperse development beyond existing infrastructure on large lots converting critical agricultural land in the Central Valley. Despite its separation from the City of Los Angeles by the Angeles National Forest, the Antelope Valley is the antithesis of leap-frog development. It is connected to Los Angeles by high-

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[3] *Coalition of Los Angeles County Planning v. County of Los Angeles*, 76 Cal.App. 3d 241, 142 Cal. Rptr. 766 (1977).
[4] See New York Times, March 10, 2002 "Sprawl Weary Los Angeles Buildings Up and In".

capacity road and now rail infrastructure, and is an important mixed- use regional center with complete infrastructure systems. It will accommodate the large increases in population anticipated in 2040 (See Part VI below).

2. The Antelope Valley Alignment Is Consistent With State, Regional And Local Agricultural Preservation Policies. Agricultural preservation is not only a key element of Smart Growth, it is particularly important to Southern California and the Central Valley because of the vast economic importance of farming to the state's economy. Protection of the sensitive and valuable agricultural resources of the Central Valley through reduction of the conversion of prime agricultural lands to urban development, and preservation of open space and environmentally sensitive lands is a key part of state, regional and local policy (See Part IV, below).

3. The Antelope Valley Alignment Addresses The Population Impacts Of High Speed Rail Infrastructure In A Way That Supports Regional Smart Growth Policies. Without the Antelope Valley alignment, excessive growth occurs in the Central Valley. The Grapevine Alignment passes over the areas of north Los Angeles that are needed and capable of accommodating future growth and development and substitutes excessive growth in the Central Valley. (See Part III, below).

4. The Antelope Valley Alignment Places Transportation Facilities And Related Growth In Palmdale Where Infrastructure Is Already In Place. Reducing urban sprawl is accomplished by promoting redevelopment and infill of Palmdale's existing incorporated built up areas is discussed in (See Part V of this Report).

5. The Antelope Valley Alignment Positions The Palmdale Transportation Center As A True Mixed Use Transportation Corridor Center. The Antelope Valley has developed the range of uses needed to support transportation and land use policies embodied in state laws such as the Transit Village Planning Act. The Palmdale transportation center can generate substantial long-term leasehold revenue and concession income through joint public-private development that will directly mitigate high speed rail alignment costs. The Antelope Valley alignment provides integration with transportation and infrastructure policies for Lancaster and Palmdale by (a) rerouting a percentage of commuter traffic off Rte 14; (b) establishing a transit hub to increase transit ridership reducing projected traffic volume increases along Interstate 5, particularly on the highly congested segments south of Rte 14; and (c) creating major public capital and service cost savings for infrastructure, operation, maintenance and public service costs, through having adequate public facilities at time of development, eliminating the major concerns related to discontinuous development (see Part VII, below).

6. Local Land Use Policies Support High Speed Rail Infrastructure. Palmdale's general plan and zoning regulations accommodate transit supportive land uses and densities, as well as a wide range of uses within the station influence area. These

uses are uniquely supportive of the intercity rail system that the high speed rail network will provide. (See Part VIII below)

It is the Report's conclusion that the Palmdale alignment is superior to the Grapevine alignment because it meets and enhances state, regional and local growth management goals, objectives, policies and strategies.

II. The Sprawl - Smart Growth Dichotomy

A. Smart Growth Principles[5]

An appropriate high speed rail alignment encourages balanced communities providing housing, employment, shopping and recreational opportunities for a diverse population. Key principles[6] of Smart Growth are summarized below:

- Develop a range of housing opportunities and choices through density and compactness
- Establish walkable neighborhoods to reduce the number and length of trips
- Foster distinctive, attractive places with a strong sense of community
- Utilize General and Specific Plans, goals, objectives, policies and strategies
- Mix land uses to create jobs-housing balance reducing transportation congestion and improving air quality
- Preserve open space, farmland, natural resources and critical environmentally sensitive lands
- Provide a variety of transportation demand management choices and techniques
- Strengthen and direct development towards existing communities
- Utilize existing infrastructure capacity before extending new capacity

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[5] Douglas R. Porter, et al, Making Smart Growth Work (June 2002); F. Kaid Benfield, et al, Solving Sprawl: Models of Smart Growth in Communities Across America (October 2001); John R. Nolon, Well Grounded: Using Local Land Use Authority to Achieve Smart Growth by (July 2001); Terry S. Szold & Armando Carbonell, Smart Growth: Form and Consequences (Lincoln Institute of Land Policy, June 2002); Jane S. Shaw & Ronald D. Utt. Ed., A Guide to Smart Growth: Shattering Myths, Providing Solutions (Property and Environment Research Center [PERC] 2000); David O'Neill, Smart Growth Took Kit: Community Profiles and Case Studies to Advance Smart Growth Practices (Urban Land Institute 2000); Urban Land Institute, ULI on the Future: Smart Growth-Economy, Community (October 1998); Robert H. Freilich, From Sprawl To Smart Growth: Successful Legal, Planning and Environmental Systems (ABA, 1999); Irving Schiffman, Alternative Techniques for Managing Smart Growth (2nd Edition 1999); Institute of Transportation Engineers, Smart Growth: Transportation Guidelines (2003); Leora Waldner & Jerry Weitz, Smart Growth Audits (American Planning Association, Planning Advisory Service Report No. 512, 2003); International City Management Association, Getting to Smart Growth: 100 Policies for Implementation (2002); International City Management Association, Getting to Smart Growth II: 100 More Policies for Implementation (2003).

[6] About Smart Growth, Smart Growth Network, http/www.smartgrowth.org/about/default.asp 11/3/03.

The balance of the Report demonstrates that the Palmdale Alignment fulfills each of these principles.[7]

Smart growth is the antithesis of sprawl.[8] A recent state Supreme Court decision aptly defines sprawl as: "The term 'sprawl' is typically used to describe development that embodies inefficient use of land (i.e. low density); constructed in a "leap frog" manner in areas without existing infrastructure, often on prime farmland automobile dependent and consisting of isolated single use neighborhoods requiring excessive transportation."[9] Since 1968 the control of urban sprawl has been national policy,[10] particularly control of low density development.[11]

Many environmental impacts are brought about by a sprawling growth pattern:

- Loss of prime agricultural and environmentally sensitive lands;
- Degradation of critical habitat;
- Erosion of steep slopes;
- Increased water pollution;
- Alteration of natural hydrologic features; and
  A reduction in air quality.[12]

After World War II, the enormous demand for housing coupled with mortgage subsidies and an explosion of subsidized infrastructure projects (particularly the Interstate Highway system) accelerated per capita consumption of farmland, ranchland, forests and open-spaces. This acceleration was abetted by local government development regulations that mandated large minimum lot sizes as a method to control sprawl.[13]

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[7] Douglas R. Porter, et al, Making Smart Growth Work (June 2002); F. Kaid Benfield, et al, Solving Sprawl: Models of Smart Growth in Communities Across America (October 2001); John R. Nolon, Well Grounded: Using Local Land Use Authority to Achieve Smart Growth by (July 2001); Terry S. Szold & Armando Carbonell, Smart Growth: Form and Consequences (Lincoln Institute of Land Policy, June 2002); Jane S. Shaw & Ronald D. Utt. Ed., A Guide to Smart Growth: Shattering Myths, Providing Solutions (Property and Environment Research Center [PERC[2000); David O'Neill, Smart Growth Took Kit: Community Profiles and Case Studies to Advance Smart Growth Practices (Urban Land Institute 2000); Urban Land Institute, ULI on the Future: Smart Growth-Economy, Community (October 1998); Irving Schiffman, Alternative Techniques for Managing Smart Growth (2nd Edition 1999); Institute of Transportation Engineers, Smart Growth: Transportation Guidelines (2003); Leora Waldner & Jerry Weitz, Smart Growth Audits (American Planning Association, Planning Advisory Service Report No. 512, 2003); International City Management Association, Getting to Smart Growth: 100 Policies for Implementation (2002); International City Management Association, Getting to Smart Growth II: 100 More Policies for Implementation (2003).

[8] About Smart Growth, Smart Growth Network, http/www.smartgrowth.org/about/default.asp, 11/3/03.

[9] In Re Dolington Land Group 839 A.2d 1021 (Pa. 2003).

[10] The National Commission On Urban Problems, Building The American City 245 (1968) "The prevention of urban sprawl should therefore qualify as a valid public purpose justifying the use of valid zoning and timing regulations in order to postpone urban development in areas inappropriate for development."

[11] Density is one of the major quantifiers of The Sierra Club 1999 Sprawl Index Report.

[12] Bruce Katz, The Permanent Campaign Against Sprawl, Urban Land (2003).

[13] Richard Cutler, Legal and Illegal Means of Controlling Community Growth on the Urban Fringe 1961 Wis. L. Rev. 371.

B. Palmdale and Smart Growth

The City of Palmdale lies 60 miles north of Los Angeles in the high desert region of Los Angeles County. It is one of two incorporated cities and several unincorporated communities within the Antelope Valley. The city is bordered by the city of Lancaster to the north and unincorporated areas on all other sides of its corporate boundaries.[14]

The City is strategically located with respect to the Antelope Valley, San Joaquin Valley, Owens Valley and the San Fernando Valley/Los Angeles basin. It has direct access to State Route 14 (Antelope Valley Freeway) and Highway 138, rail access via the Southern Pacific Transportation Company, and airport and public transportation facilities. It is the most southerly community in Antelope Valley. The City has approximately 95 square miles and has an adopted sphere of influence containing approximately 174 square miles. (Plan at 1-5). 79% of the planning area is vacant, but served with adequate public facilities, meeting smart growth infill objectives. (Plan at 1-11).

Palmdale and Lancaster's position in the region is analogous to the "New Town" concept, which directs jobs and housing to self-contained communities outside of the traditional regional urban core.[15] Rather than continuing the sprawl dispersal of low-density development, the "New Town" concept establishes new communities that are sized appropriately to insure that population is accommodated on far less land than under sprawl development. As per capita land consumption decreases, more land resources (e.g., open space, habitat and agricultural lands) are retained and traffic congestion reduced through trip length reduction and air quality is vastly improved.

Master planned "New Towns" include meaningful open spaces designed to protect the natural environment, provide paths for pedestrian and light vehicle traffic while improving the marketability of the development by providing natural amenities. The Woodlands in Montgomery County, Texas, was designed in the early 1970's under the Federal New Communities Act 42U U.S.C. §§3901-14 (1968) to protect natural drainage patterns, water quality and provide pathways for non-motorized movement. As of January 2002, The Woodlands had 120 miles of trails and over 1,800 acres of open space, primarily forested land and riparian corridors. The large preserves of open space often featured in master planned "New Towns" protect the physical environment (e.g., reduced stormwater runoff and erosion), and provide habitat for flora and fauna.

New Towns facilitate environmental sustainability because the developer is required to concentrate development in areas with the least environmental impact. In contrast, suburban fringe development reduces opportunities to retain or create linkages between open space areas because land costs are higher and land supplies are constrained. Given these constraints, there is greater pressure to develop in environmentally hazardous zones (e.g., steep slopes, fire hazard zones, liquefactions zones, and floodplains). The

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[14] City of Palmdale General Plan (adopted January 25, 1993), at 1-13.

[15] Avin, "Should We Copy Columbia?", Planning (Feb. 2004), at 27.

inevitable cost of conventional development in hazardous areas in California is the loss of life and property to mudslides, fires, earthquakes and floods.

C. Economic Development

New town development has distinct economic development advantages over contiguous fringe development of existing metropolitan areas. Conventional development in fringe areas typically consists of segregated residential, commercial and employment areas. This pattern generates distinct problems for commercial and employment uses in addition to increasing traffic congestion.

Development of conventional, free-standing regional commercial facilities draws sales from existing built up area centers, which results in business failures, blight and reduced sales tax revenues. As regional fringe facilities lure customers from existing built up areas, existing commercial development becomes less profitable and space is under-used or vacated. Vacated or partially used commercial properties (grayfields) fail to produce revenues needed for proper maintenance of the property or public services. Reduced demand on existing streets, schools and utilities result in unused and unfunded public infrastructure. Where multiple jurisdictions are involved, sales tax revenue is siphoned from the existing built up jurisdictions. All of these factors contribute to urban blight (from public and private disinvestment).

The impact of development of office and industrial sites in outlying areas is less clear. If existing built up area employment remains strong, the dispersal of employment to outlying areas may reduce traffic congestion and air quality problems by stimulating reverse commutes. The development of new towns avoids the negative impacts on existing neighborhood stability caused by sprawl. To succeed, new towns must be built on the neighborhood unit basis and balance commercial development with its supporting residential roof-tops ("jobs-housing balance"). The "neighborhood unit" concept is reflected in Palmdale's careful balance of residential, commercial and civic uses. The location of commercial development in a non-contiguous new town community does not siphon significant sales from existing core communities. Consequently, commercial development is phased to primarily reflect internal demands.

The failure of businesses related to the dispersal and relocation of population has a direct impact on capital investment. Loan defaults reduce financial institution investment in property because of depreciating property values and customer base loss. Disrepair and disinvestment follow. As noted by the Bank of America:

> "Sprawl has created enormous costs that California can no longer afford. Ironically sprawl has shifted from an engine of growth to a force that now threatens to inhibit growth and degrade the quality of life." Bank of America Report "Beyond Sprawl" (1995)

The experiences of Columbia, Maryland, Reston, Virginia and the Woodlands, Texas suggest that new towns have a net positive benefit on regional employment and industrial development. New towns have been very successful in attracting businesses from outside the region. New towns produce a ripple of new jobs throughout the region. In the case of Palmdale, the creation of additional employment center brings significant benefits by attracting commuter trips to Palmdale that otherwise would be contributing to the high existing levels of congestion along Rte 14 and I-5 south of the Rte 14 interchange.

D. *Fiscal Impacts*

Palmdale does not have the negative fiscal impacts that recent studies attribute to contiguous fringe sprawl development.[16] Fringe development relies on infrastructure of the core community to supplement its physical and social infrastructure needs without contributing its fair share to its funding. By contrast, Palmdale already has a full complement of urban services including multi-modal transportation facilities, water, sewer, police, fire, emergency service, parks and stormwater management.

The costs of constructing and servicing utility infrastructure in low-density sprawl development patterns exceed those of concentrated new town development. A dispersed land use pattern requires longer lengths of water, sewer, stormwater, electric power, telephone, natural gas and other service lines to serve the same population. Large minimum lot sizes separate uses and require greater infrastructure investments per customer. Consequently the installation, maintenance and replacement costs are greater in low-density subdivisions. These costs are typically 3 to 9 times higher in sprawled development versus planned moderate density development. The difference in water and sewer line length in sprawl (uncontrolled) growth versus smart growth (controlled) development is very evident in the western region of the United States.[17]

These higher maintenance costs of infrastructure per development unit are paid for by utility ratepayers and taxpayers.[18] Even assuming that development fully funds the initial capital costs, maintenance and replacement costs are assigned to local governments' general utility rate payers or general fund tax payers once the new infrastructure is dedicated to the public. Property owners who have paid user fees and property taxes for many years are expected to continue to do so to support long-term maintenance of inefficient sprawl development and to fund the resolution of infrastructure deficiencies. These are direct subsidies that existing taxpayers provide for inefficient sprawl development that depletes the ability of existing built up areas to regenerate themselves.[19]

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[16] Robert W. Burchell, Fiscal Impacts of Alternative Land Development Patterns in Michigan: The Cost of Sprawl Development Versus Compact Growth, South-East Michigan Regional Council of Governments (1977).

[17] Robert W. Burchell, George Lowenstein, William R. Dolphin and Catherine C. Galley, Costs of Sprawl – 2000, Transportation Research Board – National Research Council, National Academy Press, New York, 2002, pg. 222.

[18] Few local governments actually establish fees to fully fund the on and off-site impacts of new development for all infrastructure costs. Franklin J. James, Evaluation of Local Impact Fees as a Source of Infrastructure Finance, 11 Mun. Finance J. 408 (1990).

[19] Eric D. Kelly, Managing Community Growth: Politics, Techniques and Impacts (1993); John DeGrove, Balanced Growth, A Planning Guide for Local Government (1991).

Not only does Palmdale fund all of its initial capital costs, but through efficient community design, its on-going maintenance and operations costs are much lower than for conventional fringe area development. The mix of uses and the high degree of connectivity between uses produce the following cost savings:

- Reduced road maintenance costs due to reduced per unit trip generation, reduced average trip length and reduced lot frontage per unit resulting from the compact development pattern;
- Reduced school, police, fire and emergency service transportation costs;
- Fully funded operations for water and wastewater services;
- More efficient transit service due to higher densities along transit routes;
- Reduced off-site transportation costs due to greater internal capture of trips than conventional development.

E. *Social Costs of Sprawl*

One frequently cited characteristic of sprawl is the homogeneous land use pattern, which segregates residential from non-residential uses and isolates socio-economic and demographic groups within the housing market. Conventional suburban development converts large tracts of land into single-use developments and residential subdivisions that serve a narrow segment of the public. This uniformity of housing type plays to the human instinct to congregate with those similar to oneself ("monoculture").[20] The targeted housing market segregate people by age, income, race, ethnic and national origin.

New town development recognizes the benefits of diversity in housing options by providing a variety of housing sizes, densities and a mixture of land uses. Built around the neighborhood commercial center, the mixture of housing for various market segments typically includes:

- Loft apartments above retail and service businesses;
- Townhouses and other forms of attached housing;
- Apartment buildings and complexes;
- Accessory dwellings attached to single-family structures; and
- Assisted living and other alternatives that serve the variety of household ages and incomes anticipated within a community.

Jobs-housing balance coupled with affordable and workforce housing present distinct advantages for new towns over conventional development. Sustainable new town development with a balance of housing, employment, shopping, education and recreation opportunities, limits the need for frequent highway trips. The reduction of highway trips equates to a reduction in traffic fatalities and increased walkability promotes better

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[20] Andres Duany, Elizabeth Plater-Zyberk, Jeff Speck, Suburban Nation – The Rise of Sprawl and the Decline of the American Dream, North Point Press, New York, 2000, pg. 43.

health.[21] Within the town, connectivity, streetscaping and traffic calming measures combine to reduce the likelihood and severity of traffic accidents. Pedestrian facilities, light vehicle paths and well-designed intersections can reduce the number of pedestrian, light vehicle and automobile conflicts. By providing its regional fair share of affordable and attainable housing, Palmdale will create a balanced opportunity for all residents.

F. Capital Facility And Service Planning

The inefficient provision of infrastructure and services is the most significant fiscal cost of sprawl. Failure to establish efficient development patterns has increased the cost of providing adequate public facilities and funding ongoing maintenance and operations of public services. These costs typically are shifted back to existing residents and businesses, thereby reducing funding for core areas and/or causing the need for significant increases in user fees and/or tax rates.[22]

The costs of providing services for sprawl development is at least double, compared to development located close to existing facilities.[23] New development in "leapfrogged" areas exhibit scattered, inefficient development patterns of low density, with a concomitant loss of scale economies and increased housing costs.[24] "Sustainability,"[25] "growth management" and "fiscal conservatism" concepts form the basis for Smart Growth by encouraging and requiring responsible development, as communities try to balance jobs, the environment and social well-being across a constantly evolving and changing landscape.[26]

Financial responsibility for community facilities and services shifted to rate payers, assessment districts and user fees, and was borne only partially by the developer or new home owner.[27] As expectations for local government service rose, the general fund, comprised of property and other taxes and fees, became an alternate source to subsidize facility and services demanded by new development. Communities failed to make new growth pay for needed infrastructure and services creating trillions of dollars in infrastructure deficiencies alone.[28] In the wake of unprecedented public obligations for providing facilities and services, communities now must recognize that new growth must

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21 Martha T. Moore, Suburban Designs Could Be Bad For Your Health, U.S.A. Today, April 22, 2003; Frumkin, Urban Sprawl and Public Health, 117 Public Health Reports 201 (2002).

22 City of Palmdale General Plan (adopted January 25, 1993), at 1-13.

23 James E. Frank, *The Costs of Alternative Development Patterns* (1989) at 39.

24 See James Heilburn, Urban Economics and Public Policy (1981) 117-152.

25 *See Earth Summit in Rio, Sustainable Development* (1992), *BioDiversity: The United Kingdom Action Plan* (1994).

26 *See* Robert H. Freilich & Michael M. Shultz, *Model Subdivision Regulations* (1995); *see also* Virginia W. Maclaren, *Urban Sustainability Reporting*, 62 Journal of the American Planning Association 184, 185 (1996).

27 Franklin J. James, *Evaluation of Local Impact Fees As A Source of Infrastructure Finance,* 11 Mun. Fin. J., 408, 414 (1990).

28 See Hard Choices, Summary Report of the National Infrastructure Study, Joint Economic Committee, U.S. Congress (February 1984); Nancy S. Rutledge, Public Infrastructure As A National Concern; Report of the National Council on Public Works Improvement, 17-18 (1987); The American Society of Civil Engineers reports current deficiencies in transportation infrastructure alone to be $1.3 trillion dollars. ASCE, Report Card for America's Infrastructure (2003).

pay for its own one-time cost of capital infrastructure so that the general fund can be utilized to cover infrastructure deficiencies, operation and maintenance.[29]

III. Population Impacts

A. *High Speed Rail Land Use Patterns and Population Redistribution*

The statewide[30] and regional[31] high speed rail Environmental Impact Reports document that the high speed rail system will have a significant impact on future land use patterns. Population will increase by 15.2 million in Southern California and the Central Valley by 2040. The State EIR (§ 5.3) establishes extraordinary forecasts:

- A shift in residential population between Los Angeles and Kern counties due to change in accessibility between the Modal and HST Alternatives (long distance commutes)
- changes in densification/development patterns
- reallocation of population between developed and undeveloped areas including consumption of undeveloped land will be prominent
- the HST alternative will accelerate South Central Valley growth by 95.1% versus 47.1% for Southern California (Table 5-3-3).
- growth in the South Central Valley of 273,000 will out balance Los Angeles County of 118,000 (Table 5.3.4).

Without a Palmdale stop, the travel time from Bakersfield to Los Angeles declines from 2-4 hours by car to 47 minutes on high speed rail, distributing an excessive proportion of population increase to Bakersfield, as travel times become shorter and less expensive than automobile trips on I-5 in severe congestion.[32] The State EIR (§ 5.3.6) states that: "An HST system would improve accessibility to labor and customer markets. With this second effect businesses that locate close to an HST station could operate more efficiently than elsewhere – creating a competitive advantage for high-wage employment sectors." Bypassing Palmdale will severely accelerate the rate of growth in Bakersfield

29 *See* Freilich and Morgan, Municipal Strategies For Imposing Valid Development Exactions, 10 Zoning and Planning L. Rep. 169 (1987); *See also* U.S. Supreme Court cases upholding development exactions if based upon proper municipal studies proportioning the cost. *Nollan v. California Coastal Commission*, 483 U.S. 825 (1987), *Dolan v. City of Tigard*, 114 S.Ct. 2309 (1994), all discussed in Freilich and Bushek, Exactions, Dedication and Impact Fees, APA Press (1995).

30 California High Speed Rail Authority and United States Department of Transportation, Federal Rail Administration, *Draft Program Environmental Impact Report/Environmental Impact State (EIR/EIS) for the Proposed California High-Speed Train System* (January 2004) (hereinafter "State EIR").

31 The regional EIR/EIS is a series of reports including: P&D Consultants, Inc., Bakersfield to Los Angeles Sections 4(f) and 6(f) Technical Evaluation (January 2004); P&D Consultants, Inc., *Bakersfield to Los Angeles Region Land Use And Planning, Communities And Neighborhoods, Property, & Environmental Justice Technical Evaluation* (January 2004); and P&D Consultants, Inc., *Bakersfield-To-Los Angeles Traffic, Transit, Circulation & Parking Technical Evaluation* (January 2004).

32 Kaveh V. Vessali, Land Use Impacts of Rapid Transit, 11 BERKELEY PLAN. J. 71, 72-73 (1996)(decreasing commute costs provide incentives for workers to move, both farther out and along lower-cost corridors).

and Kern County by shifting growth from the Antelope Valley (Palmdale, Lancaster and unincorporated northern Los Angeles and southern Kern Counties), to the Central Valley.

B. Transit Impacts on Growth

Empirical evidence demonstrates that the high speed rail alignment will have a significant impact on growth in north Los Angeles and the Central Valley.[33] This was demonstrated by the experience of "streetcar suburbs" at the turn of the century in all major metropolitan areas of the country including Los Angeles.[34] The availability of streetcars minimized the correlation between travel times and distance, thereby causing metropolitan areas to spread in a linear pattern along transportation corridors.[35]

As congestion along I-5 increases, the price of trips by automobile will increase relative to other modes of transportation such as high speed rail.[36] Rail transit has the greatest impact on station areas where it confers a distinct accessibility advantage because of the size or characteristics of the transit system operating in the region.[37]

IV. Agricultural Preservation

A. Need for Agricultural Preservation

California's farmland is rapidly disappearing. The State EIR (§ 3.8) reports that California lost approximately 497,000 acres of farmland to urbanization in the decade between 1988 and 1998, a loss rate of approximately 49,700 acres per year, and will lose 850,000 acres by 2020.[38] According to the Department of Conservation, statewide urbanization of farmland from 1998-2000 exceeded 90,000 acres for the first time since 1990-1992, with prime farmland accounting for 19% of the 91,258 new urban acres.[39] Land use policies adopted by the State of California, the City of Bakersfield, Kern County, and Central Valley regional planning efforts place heavy emphasis on the preservation of agricultural land in the Central Valley. AB 857 provides that the protection of environmental and agricultural resources such as farms and other "working landscapes" is a state planning priority. Excessive growth in the Bakersfield region

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33 Vessali, supra, at 88-92. The impacts on land use and property value are greater in suburban locations, where there is a greater improvement in accessibility and travel cost by the creation of the railway. Id. at 92.

34 Moore & Thorsnes, The Transportation/Land Use Connection (American Planning Association, Planning Advisory Service Report No. 448/449, 1994), at 17 (citing M.S. Foster, From Streetcar to Superhighway: American City Planners and Urban Transportation (1981), Wachs, "Autos, Transit, and the Sprawl of Los Angeles: the 1920's," 50 J. Am. Planning Assn. No. 3, at 297-310 (1984), and S.B. Warner, Streetcar Suburbs: The Process of Growth in Boston (1870-1900) (1978)).

35 Moore & Thorsnes, at 17.

36 Moore & Thorsnes, at 22.

37 Parsons Brinkerhoff Quade & Douglas, Inc., Transit and Urban Form, Vol. 1, Report 16 (National Research Council, Transportation Research Board, Transit Cooperative Research Program, 1996), at 29.

38 State EIS, Summary, at S-12.

39 California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program, California Farmland Conversion Report 1998 – 2000 (Dec. 2002), at 10.

created by the Grapevine alignment will inevitably spill over into other parts of the Central Valley, which is the nation's most agriculturally productive region. By contrast, the Antelope Valley alignment stop in Palmdale will eliminate unnecessary conversion of agricultural land. Excessive conversion of agricultural land to urban uses under the Grapevine alignment would be inconsistent with state, regional, and local policies to balance future growth with the protection of agricultural lands.

Agricultural preservation plays a critical role in state and national land use policy. Agricultural preservation is important for a number of reasons, including:

- ***Economic development***. California has the nation's most productive agricultural economy. The American Farmland Trust reports that: "California is by far the number one agricultural producer and exporter in the United States. With 1999 production values reaching $26.7 billion, California produced more than Texas and Iowa combined—the nation's second and third agricultural states."[40]
- ***Environmental protection***. The Williamson Act states that "agriculture constitutes an important physical, social, esthetic and economic asset to existing or pending urban or metropolitan developments." (Government Code § 51220(d)).
- ***Establishing efficient regional growth patterns***. The Williamson Act, Government Code § 51220(c), states: "discouragement of premature and unnecessary conversion of agricultural land to urban uses is a matter of public interest and will be of benefit to urban dwellers themselves in that it will discourage discontiguous urban development patterns which unnecessarily increase the costs of community services to community residents."

The importance of the high speed rail alignment is illustrated by the confluence of the Antelope Valley (the northern reach of SCAG's planning area) and Kern County (the southern reach of the Central Valley). As is illustrated in Figure 1, below, the Antelope Valley is not within a Farmland Security Zone (FSZ) County, while Kern county is within a contiguous eleven (11) county region of FSZ counties. These areas should be protected by the careful siting of high speed rail facilities, emphasizing areas outside of these important agricultural resources.

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[40] American Farmland Trust, *AFT Around The Country: California Region* at http://www.farmland.org/california/index.htm.

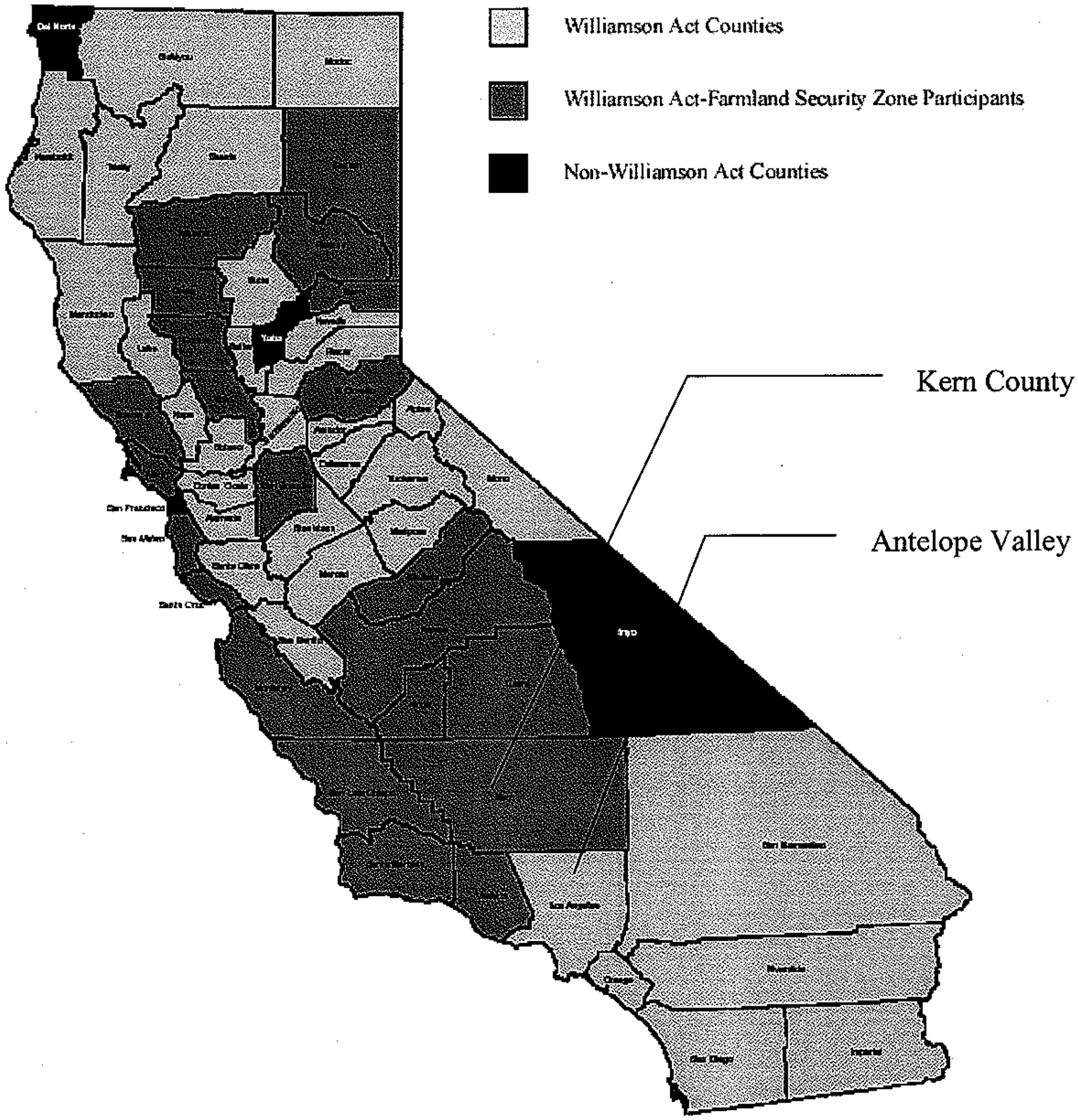

Figure 1 Williamson Act Counties (Source: California Department of Conservation, The California Land Conservation (Williamson) Act Status Report 2002, at http://www.consrv.ca.gov/DLRP/lca/stats_reports/)

B. *The Central Valley*

California's great Central Valley stretches from Shasta County to Kern County. It includes over five million people on 42,000 square miles. Bakersfield and Kern County lie in the San Joaquin Valley, which encompasses eight counties at the southern end of the Central Valley.[41] The Central Valley, anchored on the south by Bakersfield, is the

[41] Umbach, Ph.D, Kenneth W. A Statistical Tour of California's Great Central Valley (California Research Bureau CRB-97-009, August 1997)(online at http://www.library.ca.gov/CRB/97/09/index.html). The San Joaquin counties include San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and

most productive agricultural region in the world. Kern, Tulare and Fresno Counties are consistently ranked among the top three counties in the nation in agricultural production.[42] Providing over 30% of employment, it is the region's leading industry.[43]

Rapid growth in the Central Valley is threatening California's agricultural land resources. The American Farmland Trust (AFT) rates the Central Valley as the nation's most threatened farming region.[44] The Central Valley's rapid growth has caused the loss of considerable amounts of farmland to urban development.[45] A seminal 1995 study by AFT forecasts that the Central Valley will lose 1 million acres of agricultural land by 2040 if current growth trends continue.[46]

This impact is especially pronounced in Kern County. The State Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) has documented that urban land in the county has increased by 29,202 acres and irrigated farmland has decreased by 76,318 acres since 1990, with forty percent of the irrigated land decreases containing prime soils.[47] The California Department of Conservation reports that nearly 50,000 acres of important farmland were converted to urban or built up uses in the 8-year period from 1992-2000, the latest figures available (see Table 2, below).

Table 1 Farmland Converted to Urban and Built-Up Land (acres)

	1998-2000	***1996-1998***	***1994-1996***	***1992-1994***
Prime Farmland	1,300	1,491	987	2,030
Farmland of Statewide Importance	138	19	0	199
Unique Farmland	0	0	0	12
Farmland of Local Importance	0	0	0	0
IMPORTANT FARMLAND SUBTOTAL	1340	1,510	987	2,241
Grazing Land	487	183	90	149
AGRICULTURAL LAND SUBTOTAL	1,925	1,693	1,077	2,390
Urban and Built-Up Land	--	--	--	--
Other Land[(1)]	3,115	2,333	830	811
Water Area	0	0	0	0
TOTAL ACREAGE CONVERTED	5,040	4,026	1,907	3,201
Total Important Farmland (end of period)	691,903	703,387	708,739	726,291
Developed 1994-2000 [(2)]	49,923			

Kern. Fresno, Kern, Kings, and Tulare County are included in the "Southern Central Valley" for purposes of the EIR/EIS analysis of economic impacts. See EIR/EIS Document, § 5.2.2.

42 American Farmland Trust. *California Region: Southern San Joaquin Valley*, at http://www.farmland.org/california/south_san_joaquin.htm.

43 *California region: Southern San Joaquin Valley ,supra.*

44 *AFT Around the country: California region, supra.*

45 *AFT Around the country: California region, supra* (citing University of California study indicating that the state lost approximately 500,000 acres of farmland to urban development between 1988-1998).

46 American Farmland Trust. *Alternatives for Future Urban Growth in California's Central Valley: The Bottom Line for Agriculture and Taxpayers* (1995).

47 *AFT Around the country: California region, supra.*

Source: California Department Of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program, Land Use Conversion Reports, Table A-46.

(1) Includes conversion to Prime Farmland and Farmland of Statewide Importance primarily due to newly irrigated agriculture in the Antelope Valley area and agricultural boundary adjustments.
(2) The Important Farmland subtotal for 1992 was 741,826.

In addition, with much of the eastern portion of Kern county undevelopable due to government ownership or mountainous terrain, much of the growth pressure will occur in the agriculturally productive areas of the western county. These areas are contiguous to the incorporated areas of the City of Bakersfield (see Figure 2, below).

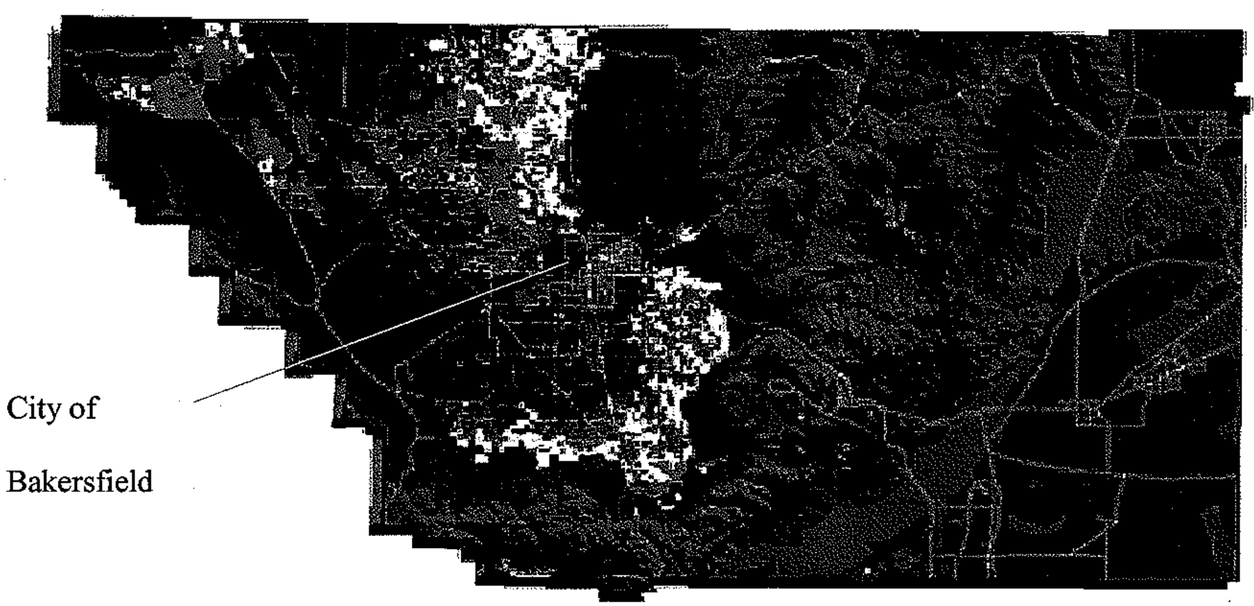

Figure 2 Kern County Permitted Cropland

Key: red - field crops, yellow - fruits, blue - nuts, and green – vegetables. Source: Kern County Department of Agriculture/Measurement Standards Geographic Information System, April 2000 (at http://www.co.kern.ca.us/kernag/our_gis.htm).

C. Impact of Alignments on Agricultural Preservation

If not carefully integrated with local land use policies and design, transit station locations can accelerate rather than deter urban sprawl.[48] The State EIR, § 5.4.7, states that the HST Alignment Options result in less farmland conversion than the base HST scenario

[48] Webber, Melvin, "The BART Experience -- What Have We Learned?" The Public Interest Vol. 12, No. 3, pp.79-110 (Fall 1976), at 90 (by heavily subsidizing and charging fares under its actual costs, BART reduced commuting expenses for outlying suburbanites and therefore encourage, rather than discouraged sprawl).

with the Palmdale scenario showing the largest reduction (2,800 acres). Total farmland conversion for alignment right-of-way – especially prime farmland - will experience the largest absolute loss of all four categories. While the right of way needs of either HST alternative will impact up to 1562 acres of farmland,[49] the secondary impacts will be catastrophic unless the Antelope Valley alignment diverts Central Valley growth. The Antelope Valley alignment is consistent with long established state growth policies. The Strategic Growth Report (discussed below) states, at ES-9: "The goal of State Policy in this regard should be to prevent conversion patterns - which means keeping development out of agricultural areas by either contiguous development to existing urban areas or by building new areas of development with a careful eye to the efficient delivery of services."

V. Impact on Sprawl

State and regional policy calls for the prevention of urban sprawl and "leapfrog" development into areas not served by infrastructure. In fact, the high-speed rail statute itself expressly provides that "the high-speed train system shall be planned and constructed in a manner that ***minimizes urban sprawl*** and impacts on the natural environment" (California Streets And Highways Code §§ 2704.09). The elimination of sprawl is statutorily required to be among the highest priorities of the system. To combat sprawl, there is sufficient capacity in the Antelope Valley to handle a significant portion of the rapid growth in Southern California and the Central Valley. According to the Brookings Institution Center On Urban And Metropolitan Policy, metropolitan Los Angeles is running out of land to accommodate an expected 6 million new residents over the next 20 years.[50] This makes the Antelope Valley a key part of the region's strategy to accommodate growth. The Antelope Valley has an abundant supply of vacant undeveloped land already served by transportation infrastructure (including arterials, transit, and airports), water, sewer, and other public utilities. By placing high capacity transportation infrastructure in the Antelope Valley, the region can absorb additional growth without extending new infrastructure beyond presently served areas. The Antelope Valley will accommodate this growth without further loss of agricultural lands, environmental resources, significant increases in trip lengths, air quality degradation, and declines in infrastructure capacity. If excess population is transferred to the Central Valley, extensive sprawl into agricultural areas not served by existing infrastructure will occur.

Local governments can ill afford to waste taxpayer dollars to expand infrastructure into areas not served by existing infrastructure. According to the American Society of Civil Engineers, a $1.3 trillion investment is needed to bring transportation infrastructure conditions to acceptable levels throughout the nation.[51] In California, total capital requirements for 1999-2009 are $82.2 billion, with total infrastructure spending

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[49] State EIS, Summary, at S-12.

[50] Southern California Studies Center and Brookings Institution Center on Urban and Metropolitan Policy, Sprawl Hits the Wall: Confronting the Realities of Metropolitan Los Angeles (2001), at 2.

[51] ASCE, Report Card for America's Infrastructure, (2003).

requirements of $150 billion when deferred maintenance is taken into consideration.[52] The California Infrastructure Plan identifies $54.2 billion in needs over five years for transportation, K-12 schools, higher education, water, administrative space, natural resources, environmental protection, public safety, and courts.[53] The California Transportation Commission reports found a ten-year total for unmet transportation needs of $117 billion for transportation infrastructure alone.[54]

Expanding infrastructure into areas not presently served also diverts scarce resources from operation and maintenance. This expense is minimized by placing new growth inducing infrastructure in existing areas such as the Antelope Valley. The State EIR shows that the HST successfully reduces sprawl only if associated with related policies, including the following:[55]

- Exploring opportunities for joint and mixed-use development at stations
- Controlling growth around stations
- Promoting urban infill
- Implementing transit supportive land use policies

This theme is echoed by other regional policy studies: "State investments in public transportation equipment and operations cannot be cost-effective without supportive land use planning and design. Transit supportive land use is a process whereby communities plan and zone for intensive, mixed use development in close proximity to transit stations or along transit corridors where physical infrastructure is typically already in place."[56] Transit stations should be located in "destinations that support high transit ridership As well as in existing urban centers where high intensities exist or will be fostered. Where intensities that support transit ridership do not already exist, it is important that future stations abut lands that can be developed or redeveloped."[57] As is described in the discussion below, station location should conform to state, regional and local land use policies to promote this objective.

VI. State, Regional and Local Land Use Policies

The Antelope Valley alignment is consistent with state, regional and local growth management strategies. The Southern California Association of Governments (SCAG) has embarked on a regional growth management strategy that directs future growth to northern and eastern cities including Palmdale, Lancaster and San Bernardino in order to address the region's deficient air quality through reduction of transportation trips and

52 David E. Dowall & Jan Whittington, *Making Room for the Future: Rebuilding California's Infrastructure* (Public Policy Institute of California, 2003), at 153.
53 California Office of Governor, *California Five Year Infrastructure Plan 2003* (March 2003).
54 California Business Roundtable, *Infrastructure*, at http://www.cbrt.org/infrastructure.html.
55 State EIS, Summary, at S-11.
56 Office of Policy and Management, Conservation and Development: Policies Plan for Connecticut 2004-2009, at 44.
57 Dane County Commuter Rail Feasibility Study, ch.3, at 2 (2004).